IN THE CLAIMS

Please amend the claims as follows:

1. (Currently amended) A method of estimating a communication channel impulse response $h(t)$, comprising the steps of:

generating a data sequence d_i having a constrained portion Cd_i associated with at least two codes w_0, w_1, wherein a correlation $A_{code}(k)$ of the constrained portion Cd_i with one of the codes w_0, w_1 is characterized by a maximum value at $k = 0$ and less than maximum values at $k \neq 0$, where k is an index for the constrained portion;

generating a chip sequence c_j having a chip period T_c as the data sequence d_i spread by a spreading sequence S_i of length N;

generating $co_m(t) = co(t + mNT_c)$ for $m = 0,1,\cdots,M$ by correlating a received signal $r(t)$ with the spreading sequence S_i, wherein the received signal $r(t)$ comprises the chip sequence c_j applied to [[the]] a communication channel; and

generating an estimated communication channel impulse response $\hat{h}_M(t)$ as a combination of $co_m(t)$ and d_m for $m = 0,1,\cdots,M$, where d_m is m-th symbol and M is number of symbols in the constrained portion used to generate the estimated communication channel impulse response $\hat{h}_M(t)$.

2. (Original) The method of claim 1, wherein the step of generating an estimated communication channel impulse response $\hat{h}_M(t)$ as a combination of $co_m(t)$ and d_m for $m = 0,1,\cdots,M$ comprises the step of computing $\hat{h}_M(t)$ as $\frac{1}{M}\sum_{m=0}^{M-1} d_m \bullet co(t + mNT_c)$.

3. (Original) The method of claim 2, wherein the at least two codes w_0, w_1 are each two symbols in length and wherein $M=2$.

4. (Original) The method of claim 1, wherein the data sequence d_i includes a preamble having a pseudorandom code including the constrained portion of the data sequence d_i.

5. (Original) The method of claim 1, wherein $A_{code}(k) = 1$ at $k = 0$ and $A_{code}(k) = 0$ for substantially all $k \neq 0$.

6. (Original) The method of claim 1, wherein $A_{code}(k) = 0$ for $0 < |k| \leq J$, wherein *J* is selected to minimize the correlation of the constrained portion Cd_i with the one of the codes w_0, w_1 for substantially all $k \neq 0$.

7. (Original) The method of claim 6, wherein *2J* is a length of the constrained portion Cd_i.

8. (Original) The method of claim 1, wherein $A_{code}(k) = 1$ at $k = 0$ and $A_{code}(k) \approx 0$ for substantially all $k \neq 0$.

9. (Currently amended) The method of claim 1, wherein each of the <u>at least</u> two codes w_0, w_1 comprises two symbols.

10. (Currently amended) The method of claim 1, wherein [[the]] each of the <u>at least</u> two codes w_0, w_1 consists of two symbols.

11. (Original) The method of claim 1, wherein the codes w_0, w_1 comprise Walsh codes.

12. (Original) The method of claim 1, further comprising the step of

filtering the estimated communication channel impulse response $\hat{h}_M(t)$ with a filter *f* selected at least in part according to the spreading sequence S_i.

13. (Original) The method of claim 12, wherein the filter *f* is further selected at least in part according to an autocorrelation $A(n)$ of the spreading sequence S_i.

14. (Original) The method of claim 13, wherein the filter *f* is further selected at least in part according to a duration of the impulse response of the communication channel $h(t)$.

15. (Currently amended) The method of claim 13, wherein the filter *f* is further selected at least in part according to a zero-forcing criteria

$\cancel{\sum_{i=-L}^{L}(A(n-i)\bullet f(i)=A_f(n),\ L\le n\le L}$ $\underline{\sum_{i=-L}^{L}A(n-i)\bullet f(i)=A_f(n),\ -L\le n\le L}$, wherein:

$f(i)$ is [[the]] <u>an</u> impulse response of the filter *f* such that $A_f(n)$ is a convolution of $A(n)$ and $f(i)$;

$A_f(n)=1$ for $n=0$ and $A_f(n)=0$ for $0<|n|\le L$; and

$A(n)=A(-n)=\sum_{i=o}^{N-1-n}S_i\bullet S_{i+n},\ 0\le n\le N$ ~~, and *N* is a length of the spreading sequence~~ $\cancel{S_i}$.

16. (Original) The method of claim 15, wherein the parameter *L* is chosen such that a time duration of the impulse response of the communication channel $h(t)$ is less than LT_c.

17. (Original) The method of claim 15, wherein the parameter *L* is chosen such that a time duration of the impulse response of the communication channel $h(t)$ is approximately equal to LT_c.

18. (Currently amended) The method of claim <u>1</u> [[12]], wherein *N* is less than 20.

19. (Currently amended) An apparatus for estimating a communication channel impulse response $h(t)$, comprising:

means for generating a data sequence d_i having a constrained portion Cd_i associated with at least two codes w_0, w_1, wherein a correlation $A_{code}(k)$ of the constrained portion Cd_i with one of the codes w_0, w_1 is characterized by a maximum value at $k = 0$ and less than maximum values at $k \neq 0$, where k is an index for the constrained portion;

means for generating a chip sequence c_j having a chip period T_c as the data sequence d_i spread by a spreading sequence S_i of length *N*;

means for generating $co_m(t) = co(t + mNT_c)$ for $m = 0,1,\cdots,M$ by correlating a received signal $r(t)$ with the spreading sequence S_i, wherein the received signal $r(t)$ comprises the chip sequence c_j applied to [[the]] a communication channel; and

means for generating an estimated communication channel impulse response $\hat{h}_M(t)$ as a combination of $co_m(t)$ and d_m for $m = 0,1,\cdots,M$, where d_m is *m*-th symbol and *M* is number of symbols in the constrained portion used to generate the estimated communication channel impulse response $\hat{h}_M(t)$.

20. (Original) The apparatus of claim 19, wherein the means for generating an estimated communication channel impulse response $\hat{h}_M(t)$ as a combination of $co_m(t)$ and d_m for $m = 0,1,\cdots,M$ comprises means for computing $\hat{h}_M(t)$ as $\frac{1}{M}\sum_{m=0}^{M-1} d_m \bullet co(t + mNT_c)$.

21. (Original) The apparatus of claim 20, wherein the at least two codes w_0, w_1 are each two symbols in length and wherein *M=2*.

22. (Original) The apparatus of claim 19, wherein the data sequence d_i includes a preamble having a pseudorandom code including the constrained portion of the data sequence d_i.

23. (Original) The apparatus of claim 19, wherein $A_{code}(k) = 1$ at $k = 0$ and $A_{code}(k) = 0$ for substantially all $k \neq 0$.

24. (Original) The apparatus of claim 19, wherein $A_{code}(k) = 0$ for $0 < |k| \leq J$, wherein *J* is selected to minimize the correlation of the constrained portion Cd_i with the one of the codes w_0, w_1 for substantially all $k \neq 0$.

25. (Original) The apparatus of claim 24, wherein *2J* is a length of the constrained portion Cd_i.

26. (Original) The apparatus of claim 19, wherein $A_{code}(k) = 1$ at $k = 0$ and $A_{code}(k) \approx 0$ for substantially all $k \neq 0$.

27. (Currently amended) The apparatus of claim 19, wherein each of the <u>at least</u> two codes w_0, w_1 comprises two symbols.

28. (Currently amended) The apparatus of claim 19, wherein [[the]] each of the <u>at least</u> two codes w_0, w_1 consists of two symbols.

29. (Original) The apparatus of claim 19, wherein the codes w_0, w_1 comprise Walsh codes.

30. (Currently amended) The apparatus of claim 19, further comprising ~~the step of~~

<u>means for</u> filtering the estimated communication channel impulse response $\hat{h}_M(t)$ with a filter *f* selected at least in part according to the spreading sequence S_i.

31. (Original) The apparatus of claim 30, wherein the filter *f* is further selected at least in part according to an autocorrelation $A(n)$ of the spreading sequence S_i.

32. (Original) The apparatus of claim 31, wherein the filter *f* is further selected at least in part according to a duration of the impulse response of the communication channel $h(t)$.

33. (Currently amended) The apparatus of claim 31, wherein the filter *f* is further selected at least in part according to a zero-forcing criteria $\cancel{\sum_{i=-L}^{L}(A(n-i)\bullet f(i)=A_f(n),\ L\leq n\leq L}$ $\underline{\sum_{i=-L}^{L}A(n-i)\bullet f(i)=A_f(n),\ -L\leq n\leq L}$, wherein:

$f(i)$ is ~~the impulse repsonse~~ an impulse response of the filter *f* such that $A_f(n)$ is a convolution of $A(n)$ and $f(i)$;

$A_f(n)=1$ for $n=0$ and $A_f(n)=0$ for $0<|n|\leq L$; and

$A(n)=A(-n)=\sum_{i=o}^{N-1-n}S_i\bullet S_{i+n},\ 0\leq n\leq N$ ~~, and *N* is a length of the spreading sequence~~ $\cancel{S_i}$.

34. (Original) The apparatus of claim 33, wherein the parameter *L* is chosen such that a time duration of the impulse response of the communication channel $h(t)$ is less than LT_c.

35. (Original) The apparatus of claim 33, wherein the parameter *L* is chosen such that a time duration of the impulse response of the communication channel $h(t)$ is approximately equal to LT_c.

36. (Currently amended) The apparatus of claim [[30]] 19, wherein *N* is less than 20.

37. (Currently amended) An apparatus for estimating a communication channel impulse response $h(t)$, comprising:

means for generating a data sequence d_i having a constrained portion Cd_i associated with at least two codes w_0, w_1, wherein a correlation $A_{code}(k)$ of the constrained portion Cd_i with one of the codes w_0, w_1 is characterized by a maximum value at $k=0$ and less than maximum values at $k\neq 0$, where *k* is an index for the constrained portion;

means for generating a chip sequence c_j having a chip period T_c as the data sequence d_i spread by a spreading sequence S_i of length *N*;

a correlator for generating $co_m(t) = co(t + mNT_c)$ for $m = 0,1,\cdots,M$ by correlating a received signal $r(t)$ with the spreading sequence S_i, wherein the received signal $r(t)$ comprises the chip sequence c_j applied to [[the]] a communication channel; and

an estimator for generating an estimated communication channel impulse response $\hat{h}_M(t)$ as a combination of $co_m(t)$ and d_m for $m = 0,1,\cdots,M$, where d_m is *m*-th symbol and *M* is number of symbols in the constrained portion used to generate the estimated communication channel impulse response $\hat{h}_M(t)$.

38. (Original) The apparatus of claim 37, wherein the estimator comprises means for computing $\hat{h}_M(t)$ as $\frac{1}{M}\sum_{m=0}^{M-1} d_m \bullet co(t + mNT_c)$.

39. (Original) The apparatus of claim 38, wherein the at least two codes w_0, w_1 are each two symbols in length and wherein *M=2*.

40. (Original) The apparatus of claim 37, wherein the data sequence d_i includes a preamble having a pseudorandom code including the constrained portion of the data sequence d_i .

41. (Original) The apparatus of claim 37, wherein $A_{code}(k) = 1$ at $k = 0$ and $A_{code}(k) = 0$ for substantially all $k \neq 0$.

42. (Original) The apparatus of claim 37, wherein $A_{code}(k) = 0$ for $0 < |k| \leq J$, wherein *J* is selected to minimize the correlation of the constrained portion Cd_i with the one of the codes w_0, w_1 for substantially all $k \neq 0$.

43. (Original) The apparatus of claim 42, wherein *2J* is a length of the constrained portion Cd_i.

44. (Original) The apparatus of claim 37, wherein $A_{code}(k) = 1$ at $k = 0$ and $A_{code}(k) \approx 0$ for substantially all $k \neq 0$.

45. (Currently amended) The apparatus of claim 37, wherein each of the at least two codes w_0, w_1 comprises two symbols.

46. (Currently amended) The apparatus of claim 37, wherein [[the]] each of the at least two codes w_0, w_1 consists of two symbols.

47. (Original) The apparatus of claim 37, wherein the codes w_0, w_1 comprise Walsh codes.

48. (Currently amended) The apparatus of claim 37, further comprising ~~the step of~~

a filter *f* for filtering the estimated communication channel impulse response $\hat{h}_M(t)$, ~~with a~~ the filter *f* being selected at least in part according to the spreading sequence S_i.

49. (Original) The apparatus of claim 48, wherein the filter *f* is further selected at least in part according to an autocorrelation $A(n)$ of the spreading sequence S_i.

50. (Original) The apparatus of claim 49, wherein the filter *f* is further selected at least in part according to a duration of the impulse response of the communication channel $h(t)$.

51. (Currently amended) The apparatus of claim 49, wherein the filter *f* is further selected at least in part according to a zero-forcing criteria

$\cancel{\sum_{i=-L}^{L} (A(n-i) \bullet f(i) = A_f(n), \ L \leq n \leq L}$ $\sum_{i=-L}^{L} A(n-i) \bullet f(i) = A_f(n), \ -L \leq n \leq L$, wherein:

$f(i)$ is ~~the impulse repsonse~~ an impulse response of the filter *f* such that $A_f(n)$ is a convolution of $A(n)$ and $f(i)$;

$A_f(n) = 1$ for $n = 0$ and $A_f(n) = 0$ for $0 < |n| \leq L$; and

$A(n) = A(-n) = \sum_{i=o}^{N-1-n} S_i \bullet S_{i+n}$, $0 \leq n \leq N$ ~~, and *N* is a length of the spreading sequence~~ $\cancel{S_i}$.

52. (Original) The apparatus of claim 51, wherein the parameter *L* is chosen such that a time duration of the impulse response of the communication channel $h(t)$ is less than LT_c.

53. (Original) The apparatus of claim 51, wherein the parameter *L* is chosen such that a time duration of the impulse response of the communication channel $h(t)$ is approximately equal to LT_c.

54. (Currently amended) The apparatus of claim 37 [[48]], wherein *N* is less than 20.

55. (New) A method of estimating a communication channel impulse response, comprising:

obtaining a received sequence via a communication channel, the received sequence comprising a chip sequence obtained by spreading a data sequence with a spreading sequence, the data sequence having a constrained portion selected such that correlation of the constrained portion with a code is characterized by a maximum value at one point in the constrained portion and less than maximum values at all other points in the constrained portion;

generating a correlated sequence by correlating the received sequence with the spreading sequence; and

generating an estimated communication channel impulse response based on the correlated sequence, the constrained portion, and the code.

56. (New) The method of claim 55, wherein the generating the estimated communication channel impulse response comprises

determining multiple data symbols based on the constrained portion and the code,

multiplying the multiple data symbols with the correlated sequence at multiple time offsets, and

generating the estimated communication channel impulse based on a sum of results of the multiplication.

57. (New) The method of claim 56, wherein the code comprises two symbols, and wherein two data symbols are multiplied with the correlated sequence at two time offsets.

58. (New) The method of claim 55, wherein the code is a Walsh code of length 2.

59. (New) The method of claim 55, wherein the constrained portion is selected such that the correlation of the constrained portion with the code is characterized by the maximum value at one point in the constrained portion and zero at all other points in the constrained portion.

60. (New) The method of claim 55, further comprising:

filtering the estimated communication channel impulse response based on a filter to obtain a filtered estimate of the communication channel impulse response, the filter being selected based on the spreading sequence.

61. (New) An apparatus for estimating a communication channel impulse response, comprising:

means for obtaining a received sequence via a communication channel, the received sequence comprising a chip sequence obtained by spreading a data sequence with a spreading sequence, the data sequence having a constrained portion selected such that correlation of the constrained portion with a code is characterized by a maximum value at one point in the constrained portion and less than maximum values at all other points in the constrained portion;

means for generating a correlated sequence by correlating the received sequence with the spreading sequence; and

means for generating an estimated communication channel impulse response based on the correlated sequence, the constrained portion, and the code.

62. (New) The apparatus of claim 61, wherein the means for generating the estimated communication channel impulse response comprises

means for determining multiple data symbols based on the constrained portion and the code,

means for multiplying the multiple data symbols with the correlated sequence at multiple time offsets, and

means for generating the estimated communication channel impulse based on a sum of results of the multiplication.

63. (New) The apparatus of claim 62, wherein the code comprises two symbols, and wherein two data symbols are multiplied with the correlated sequence at two time offsets.

64. (New) The apparatus of claim 61, wherein the code is a Walsh code of length 2.

65. (New) The apparatus of claim 61, wherein the constrained portion is selected such that the correlation of the constrained portion with the code is characterized by the maximum value at one point in the constrained portion and zero at all other points in the constrained portion.

66. (New) The apparatus of claim 61, further comprising:

means for filtering the estimated communication channel impulse response based on a filter to obtain a filtered estimate of the communication channel impulse response, the filter being selected based on the spreading sequence.

67. (New) An apparatus for estimating a communication channel impulse response, comprising a processor configured

to obtain a received sequence via a communication channel, the received sequence comprising a chip sequence obtained by spreading a data sequence with a spreading sequence, the data sequence having a constrained portion selected such that correlation of the

constrained portion with a code is characterized by a maximum value at one point in the constrained portion and less than maximum values at all other points in the constrained portion;

to generate a correlated sequence by correlating the received sequence with the spreading sequence; and

to generate an estimated communication channel impulse response based on the correlated sequence, the constrained portion, and the code.

68. (New) The apparatus of claim 67, wherein to generate the estimated communication channel impulse response, the processor is configured

to determine multiple data symbols based on the constrained portion and the code,

to multiply the multiple data symbols with the correlated sequence at multiple time offsets, and

to generate the estimated communication channel impulse based on a sum of results of the multiplication.

69. (New) The apparatus of claim 68, wherein the code comprises two symbols, and wherein two data symbols are multiplied with the correlated sequence at two time offsets.

70. (New) The apparatus of claim 67, wherein the code is a Walsh code of length 2.

71. (New) The apparatus of claim 67, wherein the constrained portion is selected such that the correlation of the constrained portion with the code is characterized by the maximum value at one point in the constrained portion and zero at all other points in the constrained portion.

72. (New) The apparatus of claim 67, wherein the processor is further configured

to filter the estimated communication channel impulse response based on a filter to obtain a filtered estimate of the communication channel impulse response, the filter being selected based on the spreading sequence.